

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

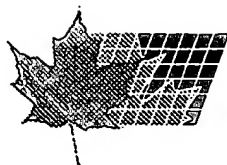
Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.



(21) (A1) 2,200,243
(22) 1997/03/18
(43) 1997/09/19

(72) RIEGER, Rainer, DE
(72) VOLLAND, Hans-Günter, DE
(72) UZICK, Wolfram, DE
(71) Witco GmbH, DE

(51) Int. Cl.⁶ C08F 4/60, C08F 4/64

(30) 1996/03/19 (96 104 295.9) EP

(54) METHODE POUR L'OBTENTION DE SYSTEMES
CATALYTIQUES ORGANOMETALLIQUES STABLES, TRES
ACTIFS; FORMULATIONS AINSI OBTENUES
(54) METHOD FOR PRODUCING HIGHLY ACTIVE, STABLE
METALLOCENE CATALYST SYSTEMS, AND
FORMULATIONS PRODUCED THEREBY

(57) Méthode pour la préparation de formulations stables, homogènes et très actives, constituées essentiellement d'une ou de plusieurs composantes catalytiques organométalliques dans des paraffines; formulations ainsi obtenues.

(57) Disclosed are a method for the production of homogeneous, highly active, stable formulations, consisting essentially of one or more organometallic catalyst components in paraffins, and formulations produced according to this method.

2200243

Abstract of the Disclosure

Disclosed are a method for the production of homogeneous, highly active, stable formulations, consisting essentially of one or more organometallic catalyst components in paraffins, and formulations produced according to this method.

METHOD FOR PRODUCING HIGHLY ACTIVE, STABLE METALLOCENE
CATALYST SYSTEMS, AND FORMULATIONS PRODUCED THEREBY

1

Background of the Invention

5 Metalocene catalyst systems are
increasingly gaining in importance as a new generation
of catalyst systems for the production of polyolefins
("Single Site Catalysts"). As is already known from
classical Ziegler-Natta catalysis, these new catalysts
essentially consist of a transition metal compound as
10 a catalyst and a cocatalyst component, for example, an
alkylaluminumoxane, in particular, methylaluminumoxane.
Cyclopentadienyl, indenyl, or fluorenyl derivatives of
group IVA of the Periodic Table of the Elements are
preferably used as the transition metal compound. In
15 contrast to conventional Ziegler-Natta catalysts, such
systems have, in addition to a high activity and
productivity, not only the capability of a specific
control of product characteristics as a function of
the components used and the reaction conditions, but,
20 moreover, they open up access to previously unknown
polymer structures with very promising characteristics
with regard to technical applications.

In the literature, a large number of
publications have appeared having as an object the
25 production of special polyolefins with such catalyst
systems. What is disadvantageous in almost all cases,
however, is the fact that to attain acceptable
productivities, a high excess of alkylaluminumoxanes,
based on the transition metal component, is required
30 (usually, the ratio of aluminum, in the form of

1 aluminoxane, to transition metal is approximately
1000:1). Due to the high price of the
alkylaluminoxanes, on the one hand, and due to the
additional polymer work-up steps ("deashing steps"),
5 required in some cases, on the other hand, a polymer
production on a technical scale and on the basis of
such catalyst systems would frequently be
uneconomical. In addition, there is the fact that the
solvent toluene, frequently used for the formulation
10 of alkylaluminoxanes, in particular,
methylaluminoxane, is increasingly undesired for
reasons of the storage stability of highly
concentrated formulations (strong tendency to gel
formation of the aluminoxane solutions) and for
15 toxicological reasons, with respect to the application
range of the polyolefins that result in the long run.

These catalyst systems or their formulations
are very sensitive substances that undergo losses in
polymerization activity within a few hours or days.

20 Due to the high price of these modern
catalyst systems, such activity losses are not
acceptable. For economic reasons, therefore, there
has been a need for catalysts or catalyst systems
which, after production, remain highly active for a
25 longer period of time or even increase in activity.

According to World Patent No. 93/23439, the
stability of metallocene catalyst systems is attained
by a comprehensive variation of the preparation
conditions, in particular, temperature treatment.

1 This procedure is expensive, on the one
hand, and cannot generally be used because of the
sensitivity of the systems, on the other hand.

 The goal of the present invention,
5 therefore, is to overcome these disadvantages and to
develop homogeneous formulations of metallocene-based
catalyst systems that at least retain their high
polymerization activity over a long period of time.

10 Brief Summary of the Invention

 Surprisingly, it has been discovered that
the polymerization activity of metallocene catalyst
systems in the form of paraffin-containing, liquid or
15 solid formulations can be stabilized permanently. The
definition formulation, therefore, comprises catalyst
systems in high-boiling hydrocarbons (paraffins) of a
consistency which is oily or waxy at room temperature,
in which the components are dissolved, suspended, or
20 dispersed by means of suitable mixing devices.

 An object of the invention is therefore a
method for the production of homogeneous mixtures,
consisting essentially of at least one metallocene, at
least one cocatalyst, and a formulation medium,
25 wherein the preparation of the catalyst component,

 A) takes place directly in the formulation
medium according to methods which are, in fact, known;
or

 B) the metallocene-based catalyst components
30 are prepared and isolated separately and then

1 suspended, dispersed, or dissolved in the formulation
medium; or

C) a solution of the metallocene-based
catalyst component, produced according to known
5 methods, in a low-boiling solvent, is introduced, in a
first step, into the formulation medium, and in a
second step, the low-boiling solvent is removed,

D) optionally in the presence of any of the
customary inorganic or organic carrier materials,
10 auxiliaries, additives, and/or accessory agents.

Another object of the invention refers to
the formulations produced in accordance with the
method of the invention.

Other objects of the invention are
15 characterized by the claims.

Detailed Description of the Invention

The formulation media useful according to
20 this invention include all natural or synthetic,
commercially available long-chain, optionally
branched, liquid or solid hydrocarbons with boiling
points above 150°C, preferably above 200°C, and
viscosities of at least 1 Pa·sec at 25°C.

25 These compounds include the product groups
of the so-called white mineral oils, e.g. Witco White
Mineral Oil Parol® (trademark of Witco Polymers +
Resins B.V., Netherlands), petrolatum (Vaseline), and
paraffinic waxes, e.g., Terhell® (Schümann Company).

30

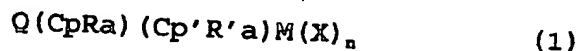
- 1 The hydrocarbon used does not depend on the organometallic compound but is determined mainly by practical requirements of future applications.
- Compounds of the elements of Groups IIA, 5 IIIA, or IVA of the Periodic Table of the Elements, preferably organoaluminum, organoboron, or organomagnesium substances, alone or in mixtures, or as a complex salt, are used as cocatalysts, in accordance with the invention, such as $R^1R^2R^3Al$, 10 $R^1R^2R^3B$, and R^1R^2Mg , wherein R^1 , R^2 , R^3 are independently of one another halogen, a heteroatom, or alkyl or alkoxy containing up to 12 carbon atoms, for example: tributylaluminum, triisobutylaluminum, trihexylaluminum, trioctylaluminum, diethylaluminum 15 chloride, ethylaluminum sesquichloride, ethylaluminum dichloride, diisobutylaluminum chloride, isobutylaluminum dichloride, diethylaluminum iodide, diisobutyl hydride, diethylaluminum methoxide, isoprenylaluminum, dimethylaluminum chloride, 20 methylaluminoxane, methylaluminum sesquichloride, tetraisobutyl dialuminoxane, trimethyl aluminum, and/or triethylaluminum, preferably in mixtures with at least one of the compounds diethylaluminum hydride, hexaisobutyltetraluminoxane, diethyl 25 (dimethylethylsilanolato)aluminum, diethyl(ethylmethylsilanolato)aluminum, diisobutyl(methylsilanolato)aluminum, tridodecylaluminum, tripropylaluminum, dipropylaluminum chloride, dibutylmagnesium, 30 butylethylmagnesium, butyloctylmagnesium,

- 1 butyloctylmagnesium ethoxide, ethylaluminum
propoxychloride, triethylboron,
tris(pentafluorophenyl)borane, and their salts.

- As a catalyst component, one can metallocene
5 compounds as described in European Patent Nos.
A-0,480,390, A-0,413,326, A-0,530,908, A-0,344,887,
A-0,420,436, A-0,416,815, A-0,520,732.

They are, in particular compounds of the
following general formula (1):

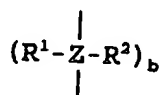
10



wherein

- Cp is a cyclopentadienyl, indenyl or fluorenyl
15 radical;
R and R' are the same or different and each is a C₁-C₁₀
alkyl, phosphine, amine, C₁-C₁₀ alkyl ether, or C₆-C₁₀
aryl ether group with 0 ≤ a ≤ 4 and 0 ≤ a' ≤ 4;
Cp' is one of the groups Cp or
20 Cp' is -NR''- wherein R'' is an alkyl or aryl radical
and a=1, and
Q is a single bridge or multi bridges

25



- between Cp and Cp', wherein R¹ and R² are the same or
different and each is a hydrogen atom, C₁-C₁₀ alkyl
group, or C₆-C₁₀ aryl group, and Z denotes carbon,
30 silicon, or germanium, wherein b is 0, 1, 2, or 3,

- 1 M is a transition metal of the groups 3 to 6 of the
Periodic Table of the Elements (IUPAC notation), in
particular Zr or Hf,
X is halogen, in particular, Cl or Br, and
5 n is the oxidation number of M, reduced by 2.

In particular, the following compounds can
be used as bridged ligands, Q(CpRa) (Cp'R'a) in general
formula (1):

- Dimethylsilylbis(1-indene),
10 dimethylsilylbis(1-cyclopentadiene), 2,2-propylbis(1-
indene),
2,2-propylbis(trismethylcyclopentadiene),
2,2-propylbis(5-dimethylamino-1-indene),
2,2-propylbis(6-dipropylamino-1-indene),
15 2,2-propylbis(4,7-bis(dimethylamino-1-indene)),
2,2-propylbis(5-diphenylphosphino-1-indene),
2,2-propylbis(4,5,6,7-tetrahydro-1-indene),
2,2-propylbis(4-methyl-1-indene), 2,2-propylbis(5-
methyl-1-indene),
20 2,2-propylbis(6-methyl-1-indene), 2,2-propylbis(7-
methyl-1-indene),
2,2-propylbis(5-methoxy-1-indene),
2,2-propylbis(4,7-dimethoxy-1-indene),
2,2-propylbis(2,3-dimethyl-1-indene),
25 2,2-propylbis(4,7-dimethyl-1-indene),
2,2-propylbis(1-cyclopentadiene),
2,2-propylbis(1-indene), diphenylmethylbis(1-indene),
diphenylmethylbis(1-cyclopentadiene),
diphenylmethylbis(1-indene),
30

- 1 diphenylsilylbis(1-indene), diphenylsilylbis(1-cyclopentadiene),
diphenylsilylbis(1-indene), ethylenebis(1-indene),
ethylenebis(trimethylcyclopentadiene),
- 5 ethylenebis(5-dimethylamino-1-indene),
ethylenebis(6-dipropylamino-1-indene),
ethylenebis(4,7-bisdimethylamino-1-indene),
ethylenebis(5-diphenylphosphino-1-indene),
ethylenebis(4,5,6,7-tetrahydro-1-indene),
- 10 ethylenebis(6-methyl-1-indene), ethylenebis(7-methyl-1-indene),
ethylenebis(5-methoxy-1-indene),
ethylenebis(4,7-dimethoxy-1-indene),
ethylenebis(2,3-dimethyl-1-indene),
- 15 ethylenebis(4,7-dimethyl-1-indene), ethylenebis(9-fluorene),
ethylenebis(1-cyclopentadiene), ethylenebis(1-indene).

- As unbridged ligands (formula (1) with $b = 0$), preferably the following compounds can be used:
- 20 cyclopentadiene, fluorene, indene, and their
monoalkylated or multialkylated derivatives, wherein
the alkyl radical can contain 1-10 carbon atoms. In
accordance with the invention, the following are
preferred:
 - 25 [bis(cyclopentadienyl)]zirconium dichloride,
[bis(methylcyclopentadienyl)]zirconium dichloride,
[bis(n-propylcyclopentadienyl)]zirconium dichloride,
[bis(isobutylcyclopentadienyl)]zirconium dichloride,
[bis(cyclopentylcyclopentadienyl)]zirconium
 - 30 dichloride,

- 1 [bis(benzylcyclopentadienyl)]zirconium dichloride,
[bis(octadecylcyclopentadienyl)]zirconium dichloride,
[bis(n-butylcyclopentadienyl)]titanium dichloride,
[bis(n-butylcyclopentadienyl)]zirconium dichloride,
5 [bis(n-butylcyclopentadienyl)]hafnium dichloride,
[bis(indenyl)]zirconium dichloride,
[bis(indenyl)]dimethylzirconium,
[bis(tetrahydroindenyl)]zirconium dichloride, [1,2-
ethylenebis(indenyl)]zirconium dichloride,
10 [1,2-ethylenebis(indenyl)hafnium dichloride,
[1,2-ethylenebis(tetrahydroindenyl)]zirconium
dichloride,
[dimethylsilylbis(1H-inden-1-yl)]zirconium dichloride,
[dimethylsilylbis(1H-inden-1-yl)]hafnium dichloride.
15 Porous oxides of one or more of the elements
of groups IIA, IIIA, or IVA of the Periodic Table of
the Elements, such as ZrO_2 , TiO_2 , B_2O_3 , CaO , ZnO , BaO ,
preferably aluminosilicates (zeolites), Al_2O_3 , and MgO
and in particular, SiO_2 (West German Patent No.
20 4,409,249), are useful as inorganic carrier materials
that can be used in accordance with the invention.
Porous, partially polymeric compounds, such
as polyethylene, polypropylene, polystyrene, and sugar
derivatives (starch, amylose, cyclodextrins), can be
25 taken into consideration as organic carrier materials
that can be used in accordance with the invention.
To prepare the formulations of the
invention, in accordance with the method of the
invention, there are basically different
30 possibilities, for example:

1 M1) Preparation of the metallocene-based
catalyst system in the dispersing /suspending medium
or solvent (paraffin), in accordance with the
invention.

5 M2) Dissolution, suspension, or dispersion
of already isolated metallocene-based catalyst
components in the dispersing medium or solvent
(paraffin), in accordance with the invention

 M3) Mixing of nonaromatic solvent or
10 dispersing agent with a solution of the metallocene-
based catalyst components and subsequent separation of
the solvent by means of distillation, thus obtaining
the solutions, suspensions, or dispersions, in
accordance with the invention.

15 To prepare the formulations, the catalyst
components can be used in pure form as well as on a
suitable support material. If the catalyst components
are used in pure form, the support material and
auxiliaries, additives, and accessory agents can be
20 added to the processing possibilities M1)-M3) at any
time.

 The following examples illustrate the
synthesis of the claimed metallocene-catalyst systems
and their testing in the polymerization.

25

30

1 Synthesis Examples

Example 1

5 Methylaluminoxane in Witco Parol® (trade name of Witco Netherlands)

402 g of a toluene solution of MAO (Al total, 13.2%; Al as TMA, 3.19%) and 219 g Witco Parol® were fed under nitrogen atmosphere to a 1-L flask, equipped with a thermometer and stirrer that moves around the edges. The flask contents were heated in an oil bath to a maximum 32°C and a vacuum was applied. The distilled-off toluene was condensed in a low-temperature trap. It was possible to strengthen the vacuum with the declining toluene content of the suspension. Toluene residues were distilled off at <1 mbar for 3 h.

A viscous and milky-turbid suspension was obtained. The suspension was neither pyrophoric nor self-igniting; slight gas generation took place on addition of water.

Al total: 13.4%

Al as TMA: 1.5%

25

Example 2

Methylaluminoxane in Witco Petroleum Jelly Snowwhite MD® (Vaseline, Witco Netherlands)

30

1 130.1 g of a toluene solution of MAO
 (Al total, 13.2; Al as TMA, 3.19%) and 85.1 g White
 Petroleum Jelly Snowwhite MD[®] were fed into a 500-mL
 Schlenk tube, equipped with a stirrer, under a
5 protective nitrogen atmosphere. After heating to 55-
 60°C in an oil bath, the mixture became homogeneous.
 The toluene was distilled off in a vacuum and
 condensed in a low-temperature trap. The vacuum was
 continuously increased to below 1 mbar, and the bath
10 temperature was maintained at a maximum of 65°C.
 After complete removal of the toluene, a colorless,
 homogeneous, waxlike mass was obtained, which flowed
 at approximately 60°C.

 The suspension was neither pyrophoric nor
15 self-igniting; slight gas generation took place on
 addition of water.

 Al total: 12.0%

 Al as TMA: 1.9%

20 Example 3

 Methylaluminoxane in paraffin wax

 33.5 g Methylaluminoxane (solid) and 16.8 g
25 paraffin (Terhell 5605[®], Schumann Company) were heated
 under nitrogen in a round-bottomed flask with a
 stirrer that moves around the edges. With a bath
 temperature of 65-70°C, a turbid melt was obtained.
 The melt was allowed to solidify while stirring and
30 then the melt was dissolved from the walls of the

- 1 flask. After cooling externally with dry ice, it was possible to comminute the solid to a fine grain solid which could be poured.

- The powder, containing approximately 66%
5 MAO, was not pyrophoric or self-igniting.
Al total: 26.1%
Al as TMA: 3.5%

Example 4

10

Methylaluminoxane in Witco Parol®

- 26.3 g of a finely pulverized MAO solid (Al total, 39.2%) were stirred with 7.3 g white oil Witco Parol® under a protective argon atmosphere. A
15 colorless, waxlike mass was obtained.

- The powder containing approximately 78% MAO was not pyrophoric or self-igniting and exhibited only a moderate gas development upon contact with water. Placed on moist filter paper, carbonization without
20 self-ignition was observed.
Al total: 30.1%
Al as TMA: 3.6%

Example 5

25

Dispersion of methylaluminoxane in petrolatum (Vaseline)

- Under a protective nitrogen atmosphere, 125
30 g of a toluene solution of MAO (Al total, 13.2%; Al as

1 TMA, 3.19%) and 78.5 g petrolatum, white, German
Pharmacopoeia 10, VARH AB (Schümann Company) were fed
into a 500-mL Schlenk tube, equipped with a stirrer.
After heating to 55-60°, the toluene was distilled off
5 and condensed in a low-temperature trap. The vacuum
was continuously increased to below 1 mbar, and the
bath temperature was maintained at a maximum 65°C.
After complete removal of the toluene, a colorless,
homogeneous dispersion was obtained, which could flow
10 at above approximately 60°C.

The suspension was neither pyrophoric nor
self-igniting; slight gas generation took place on
addition of water.

Al total: 12.3%

15 Al as TMA: 1.6%

Example 6

20 Suspension of methylaluminoxane and metallocene in
white oil

60.5 g of a toluene solution of MAO (Al
content, 13.2%; Al as TMA, 3.19%) were fed into a
stirring apparatus under a protective argon
25 atmosphere. 2.0 g EURECEN® 5036 (trade name of the
Witco Company, Bergkamen, Germany - 1,2-ethylenebis(1-
indenyl)zirconium dichloride) were added to this
solution, and stirring was carried out for 30 min. 39
g white oil Witco Parol® were metered into this dark-
30 brown solution and heated to 40°C. The toluene was

1 distilled off under a vacuum of up to 0.1 mbar and
condensed in a low-temperature trap.

56.6 g of a brown, waxlike catalyst mass was
obtained.

5

The suspension was neither pyrophoric nor
self-igniting; slight gas generation took place on
addition of water.

Al total: 14.11%

10 Zr: 0.77%

Example 7

The procedure was carried out as in Example
15 6. Before use in the polymerization, the mixture was
subjected to a 24-h aging process in toluene.

Example 8

20 The procedure was carried out as in Example
6. Before use in the polymerization, the mixture was
subjected to a 48-h aging process in toluene.

Example 9

25

Suspension of supported MAO/metallocene/silica
catalyst system in Witco Parol®

23 g of a supported catalyst system (TA
30 02954, research product from the Witco Company; Al

1 content, 23.9%, Zr content 1.1%) were stirred with
53.7 g white oil Witco Parol® in a stirred vessel
under a protective argon atmosphere. A dark-brown
suspension was obtained.

5 The suspension was neither pyrophoric nor
self-igniting; slight gas generation took place on
addition of water.

Al total: 7.17%

Zr total: 0.33%

10

Example 10

Metallocene/methylaluminoxane/silica suspension in
white oil

15

203.5 g of a 10% solution of
methylaluminoxane in toluene (Al content, 5.0%) were
introduced into an apparatus suitable for working
under a protective argon atmosphere, with stirrer,
20 thermometer, reflux condenser, and metering of solids.

18.8 g Silica (SYLOPOL 2104®, Grace Company,
with 5% water content) were thoroughly shaken with 1.5
g distilled water for approximately 10 min, poured
into the solids meter, and slowly added to the stirred
25 methylaluminoxane solution. With gas development
(methane gas), the temperature rose to 65°C. After
the end of the addition, stirring was carried out
until room temperature was once again reached, and
then 2.44 g EURECEN® 5036 1,2-ethylenebis(1-
30 indenyl)zirconium dichloride) were added. Stirring

1 was then carried out for 1.5 h, wherein the flask contents turned red-brown. Then 121.2 g of white oil (Witco Parol®) were added, in order to attain an approximately 25% suspension.

5 The toluene was completely distilled off at a maximum of 45°C and a vacuum of up to 0.1 mbar in 6 h. A red-brown, highly viscous suspension was obtained.

The suspension was neither pyrophoric nor
10 self-igniting; slight gas generation took place on addition of water.

Al total: 5.25%

Zr: 0.27%

15 Example 11

Metallocene/methylaluminoxane/silica suspension in white oil

20 52.4 g of silica (SYLOPOL® 2104) on which was supported methylaluminoxane, with an aluminum content of 23.8%, was fed under a protective nitrogen atmosphere, and 3.14 g EURECEN® 5036 were added.

111.1 g white oil (Witco Parol®) were added to this
25 mixture of solids and stirred for over 2 h. A viscous, curry-colored 33% suspension was obtained.

The suspension was neither pyrophoric nor self-igniting; slight gas generation took place on addition of water.

30 Al total: 7.48%

1 Zr: 0.38%

Comparative examples

5 In Comparative Examples 12 and 13 a
commercial MAO solution, sold by the Witco Company,
Bergkamen, Germany, under the trade name EURECEN® Al
5100/10T, was used and together with the other
catalyst components, metered directly into the
10 polymerization reactor. The concentrations of the
active catalyst material can be seen in Tables I and
II.

Polymerization results

15
Polymerization results and analytical data for
homogeneous formulations

20

25

30

2200243

-19-

1

Table I*

5

10

15

20

Example	Formulation	%Al, %Zr in Formulation	Productivity of the formulation, kg PE/mol Zr·h
1	MAO in Parol ¹⁾	13.4; 0.00	30552
2	MAO in Petroleum Jelly ¹⁾	12.0; 0.00	29880
3	MAO (solid) in paraffin	26.1; 0.00	35256
4	MAO in Parol ¹⁾	30.1 0.00	55584
5	MAO in Vaseline (Schümann) ¹⁾	12.3; 0.00	25704
6	MAO/ metallocene ²⁾ prepared in Parol and polymerized immediately	14.11 0.77	3456
7	MAO/ metallocene ²⁾ , prepared in Parol and polymerized after 24 h	14.11 0.77	29964
8	MAO/ metallocene ²⁾ , prepared in Parol and polymerized after 48 h	14.11 0.77	57288
12	MAO in toluene (Comparative Example) ¹⁾	4.84; 0.00	29328

¹⁾ = Bis(n-butylcyclopentadienyl)zirconium dichloride

²⁾ = Ethylene-1.2-bis(indenyl) zirconium dichloride

25

(MAO: 900 g/mol; metallocene, abs. conc. 1.25×10^{-6} mol Zr; Al:Zr=1000:1); 900 mL toluene; 30°C inside temperature; 4 bar ethene; 1000 rpm; 20 min)

30

1 Polymerization results and analytical data for
heterogeneous formulations

Table II

5

Example	Formulation	%Al	%Zr	Productivity kg PE/mol Zr·h
9	MAO/SiO ₂ / Metallocene, suspended in Parol ²⁾	7.17	0.33	4200
10	MAO/SiO ₂ / Metallocene, prepared in Parol ²⁾	5.25	0.27	2228
11	MAO/SiO ₂ / Metallocene, prepared in Parol ²⁾	7.48	0.38	1081
13	MAO/SiO ₂ / Metallocene, suspended in toluene (Comparative Example) ²⁾	5.25	0.27	688

10

15

20

¹⁾ = Bis(n-butylcyclopentadienyl)zirconium dichloride

²⁾ = Ethylene-1,2-bis(indenyl)zirconium dichloride

25

(MAO/SiO₂, 23.8% Al; metallocene abs. conc. 1.25×10^{-6} mole Zr; triisobutylaluminum (Al:Zr=800:1); 900 mL toluene; 40°C inside temperature; 4 bar ethene; 1000 rpm; 20 min)

30

1 What is Claimed Is:

1. A method for producing a homogeneous mixture consisting essentially of an optionally supported catalyst system consisting of at least one metallocene and at least one cocatalyst, and a formulation medium, comprising

A) preparing the catalyst system directly in the formulation medium, or

10 B) preparing separately the catalyst system and then suspending, dispersing or dissolving it in the formulation medium, or

C) introducing a solution of the catalyst system in a low-boiling solvent into the formulation medium in a first step, and in a second step removing the low-boiling solvent,

15 D) wherein the homogeneous mixture also optionally contains one or more of inorganic or organic carrier materials, auxiliary agents and additives.

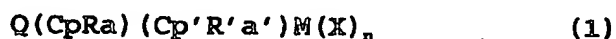
2. A method according to Claim 1, wherein one or more organoaluminum compounds are used as cocatalyst.

25 3. A method according to Claim 1, wherein one or more aluminoxanes are used as cocatalyst.

1 4. A method according to Claim 1, wherein
one or more organoboron compounds are used as
cocatalyst.

5 5. A method according to Claim 1, wherein
methylaluminoxane is used as cocatalyst.

6. A method according to Claim 1, wherein
one or more metallocenes of general formula (1) are
10 used as catalyst:



wherein

Cp is a cyclopentadienyl, indenyl, or fluorenyl
15 radical,

R and R' are the same or different and each is a C₁-C₁₀
alkyl, phosphine, amine, C₁-C₁₀ alkyl ether, or C₆-C₁₀
aryl ether group,

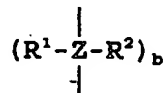
$$0 \leq a \leq 4 \text{ and } 0 \leq a' \leq 4,$$

20 Cp' is one of the groups Cp or

Cp' is -NR^o-wherein R^o is an alkyl or aryl radical in
which a is 1,

Q is a single bridge or multibridge

25



between Cp and Cp', wherein R¹ and R² are the same or
different and each is a hydrogen atom, a C₁-C₁₀ alkyl
30

- 1 group, or a C₆-C₁₀ aryl group, and Z denotes carbon,
silicon, or germanium, in which b is 0, 1, 2, or 3,
M is a transition metal of any of the groups 3-6 of
the Periodic Table (IUPAC notation),
5 X is halogen, and
n is the oxidation number of M, reduced by 2.

7. A method in accordance with Claim 6
wherein M is Zr or Hf, and X is Cl or Br.

10

8. A method in accordance with Claim 1 or
6, wherein the catalyst component is one or more
metallocenes selected from the group consisting of
(bis(cyclopentadienyl))zirconium dichloride,
15 (bis(methylcyclopentadienyl))zirconium dichloride,
(bis(n-propylcyclopentadienyl))zirconium dichloride,
(bis(isobutylcyclopentadienyl))zirconium dichloride,
(bis(cyclopentylcyclopentadienyl))zirconium
dichloride,
20 (bis(benzylcyclopentadienyl))zirconium dichloride,
(bis(octadecylcyclopentadienyl))zirconium dichloride,
(bis(n-butylcyclopentadienyl))titanium dichloride,
(bis(n-butylcyclopentadienyl))zirconium dichloride,
(bis(n-butylcyclopentadienyl))hafnium dichloride,
25 (bis(indenyl))zirconium dichloride,
(bis(indenyl))dimethylzirconium,
(bis(tetrahydroindenyl))zirconium dichloride, (1,2-
ethylenebis(indenyl))zirconium dichloride,
(1,2-ethylenebis(indenyl))hafnium dichloride,

30

- 1 (1,2-ethylenebis(tetrahydroindenyl))zirconium
dichloride;
(dimethylsilylbis(1H-inden-1-yl))zirconium dichloride,
and (dimethylsilylbis(1H-inden-1-yl))hafnium
5 dichloride.

9. A method according to Claim 1 wherein
the formulation medium is a hydrocarbon with a boiling
point above 150°C and a viscosity of at least 1 Pa·sec
10 at 25°C.

10. A homogeneous mixture produced
according to the method of claim 1.

15 11. A homogeneous mixture consisting
essentially of an optionally supported catalyst system
consisting of at least one metallocene and at least
one cocatalyst, and a formulation medium.

20 12. A homogeneous mixture according to
Claim 11 wherein said formulation medium is a
hydrocarbon with a boiling point above 150°C and a
viscosity of at least 1 Pa·sec at 25°C.

25

30